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(54) Abstract Title
Embossing assembly and relative movement system

(57) An embossing assembly (100) comprises at least one embossing module (1, 1', 1") which comprises two counter-rotating embossing rolls for embossing a sheet material, particularly for the production of paper napkins or serviettes and the like, the embossing module (1) being disposed in line with a folding plate (3) for folding of the sheet material leaving or approaching the embossing module, and being mounted so that it can be translated on a supporting plate (2) to be able to be moved from its working position during changes in production. The plate (2) has track grooves to accept balls in the module base to allow module movement. The module (1) can be moved to an aligned carriage 30 to allow a replacement module (1') to move from a standby position on the plate (2) to the working position; a further module (1") then being able to move from a reserve position on the plate (2) to the standby position.

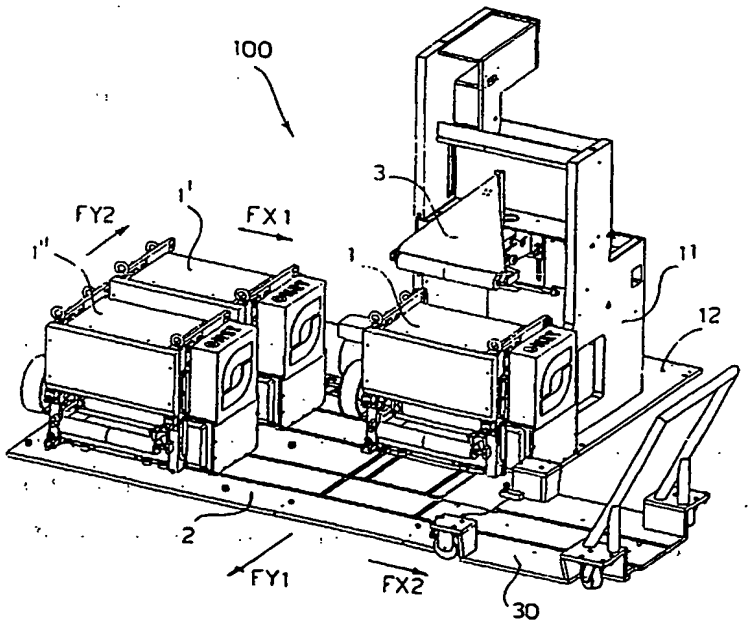

FIG. 1

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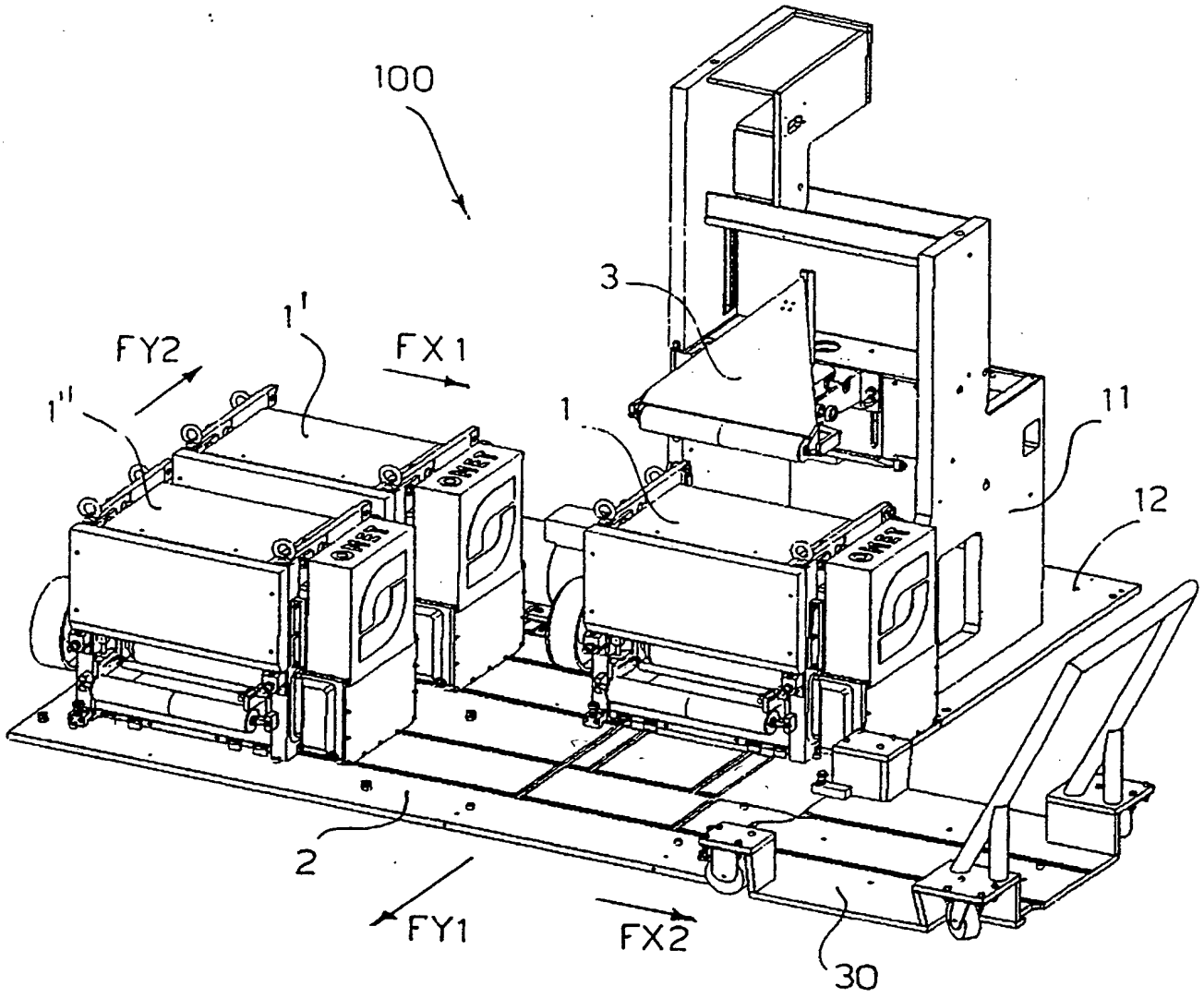


FIG. 1

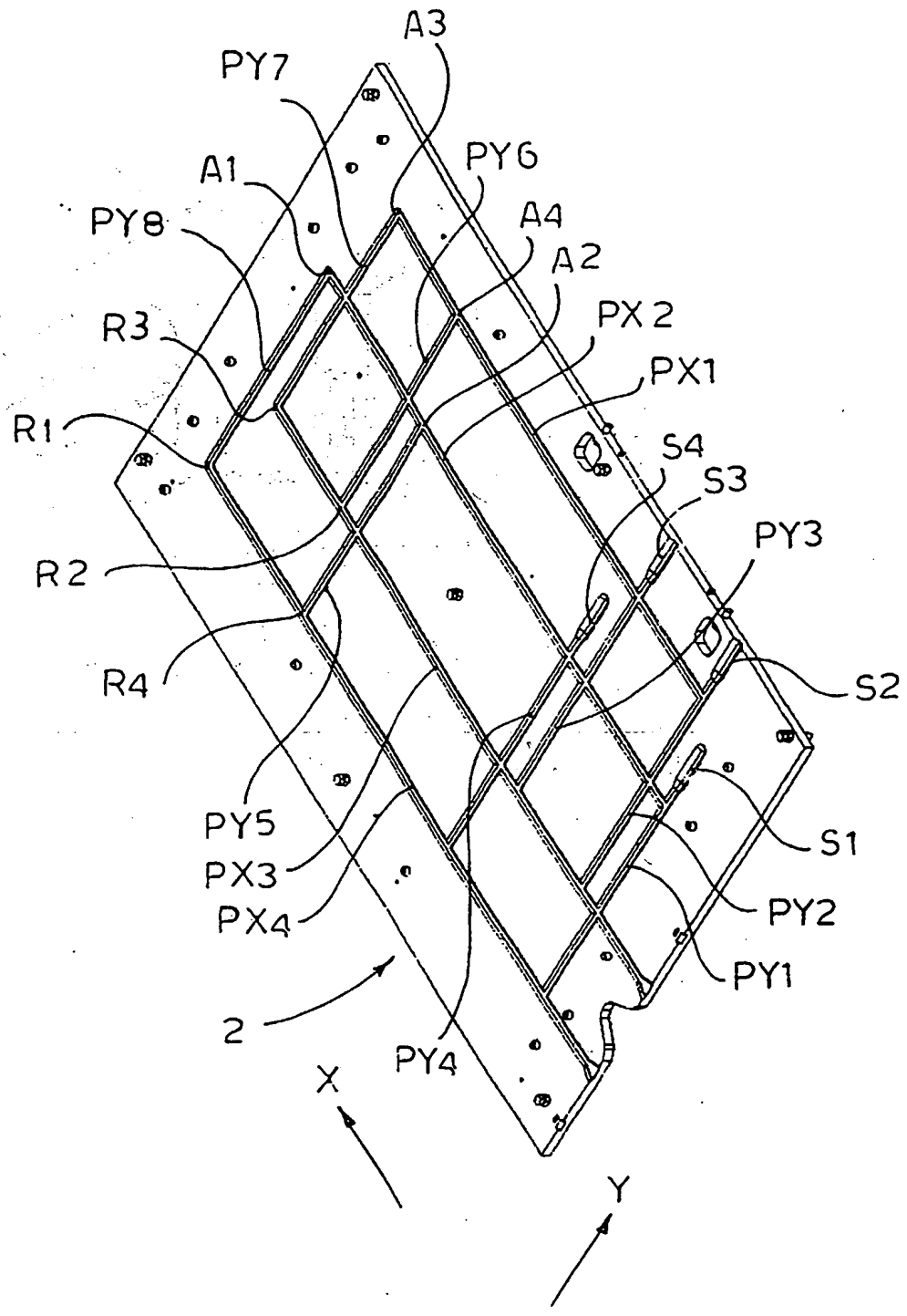


FIG. 2

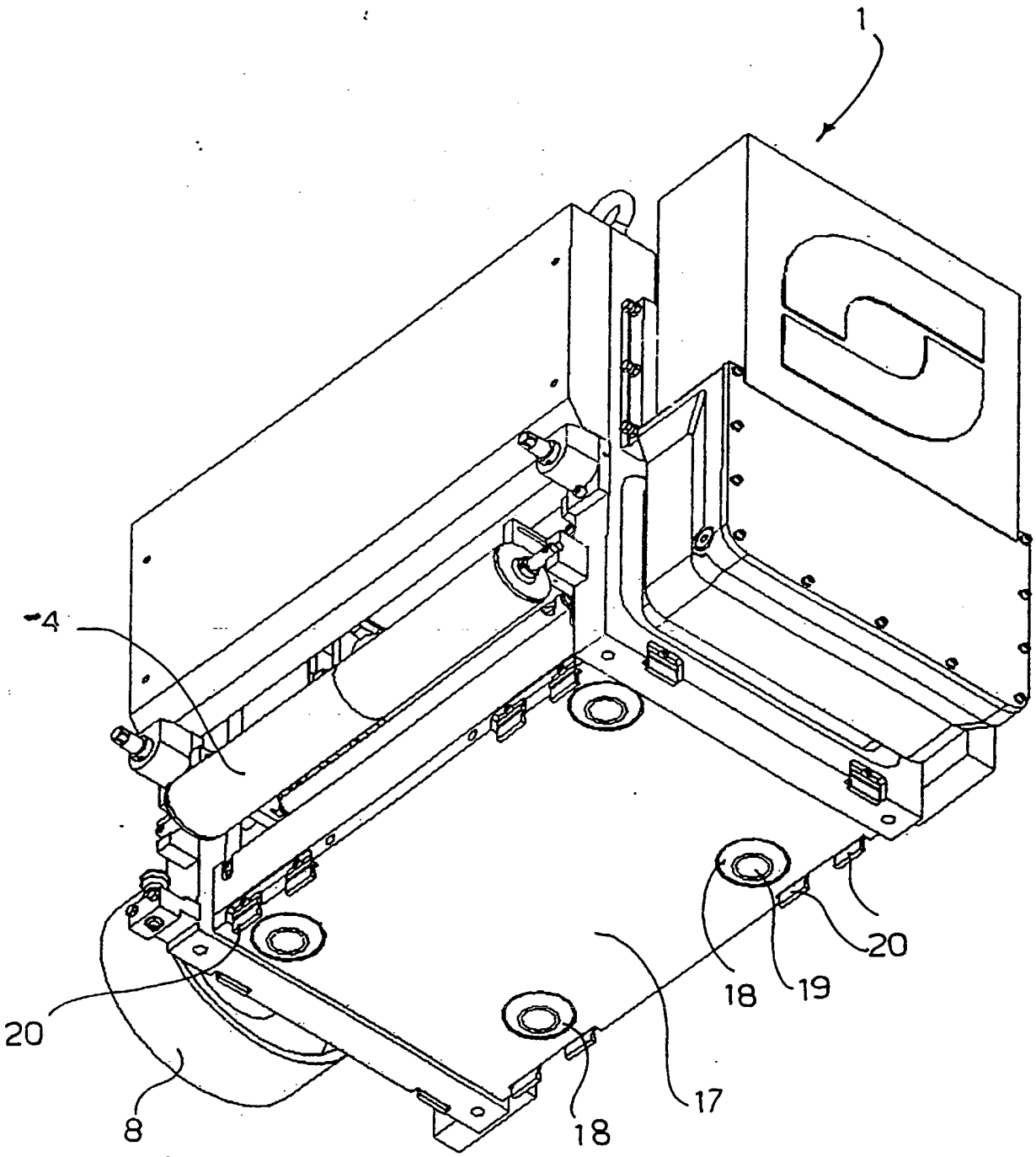
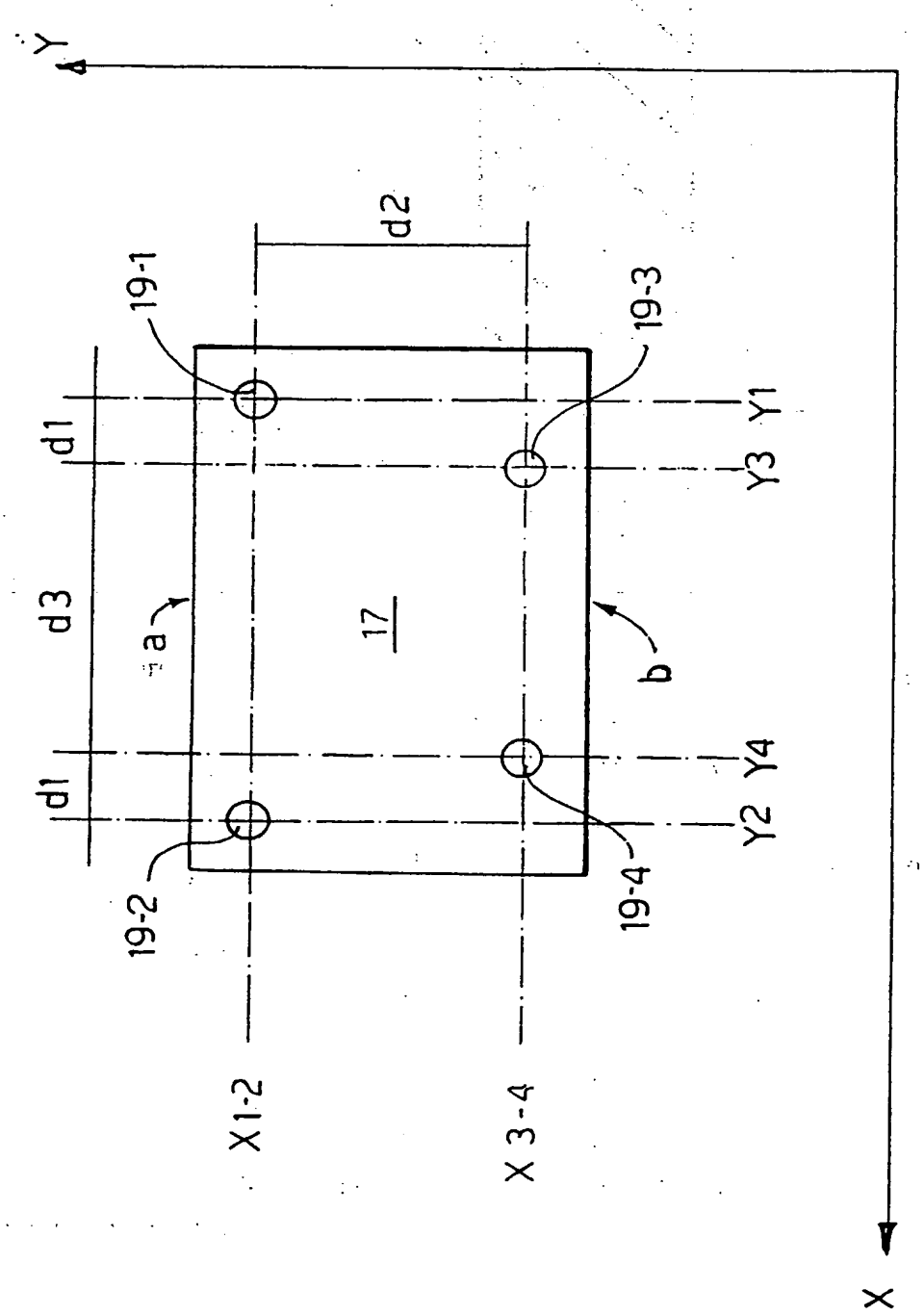


FIG. 3

FIG.3a



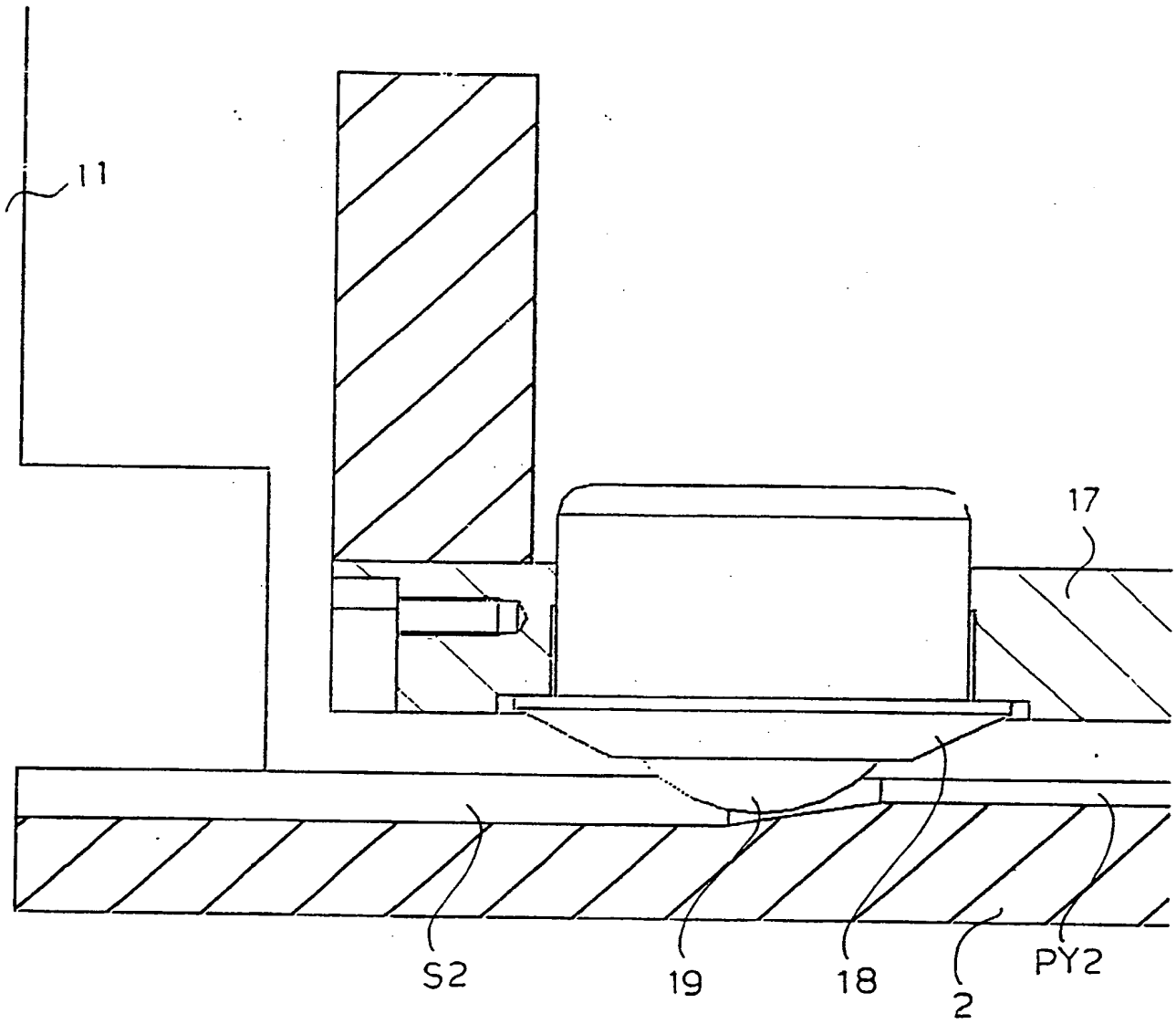


FIG. 4

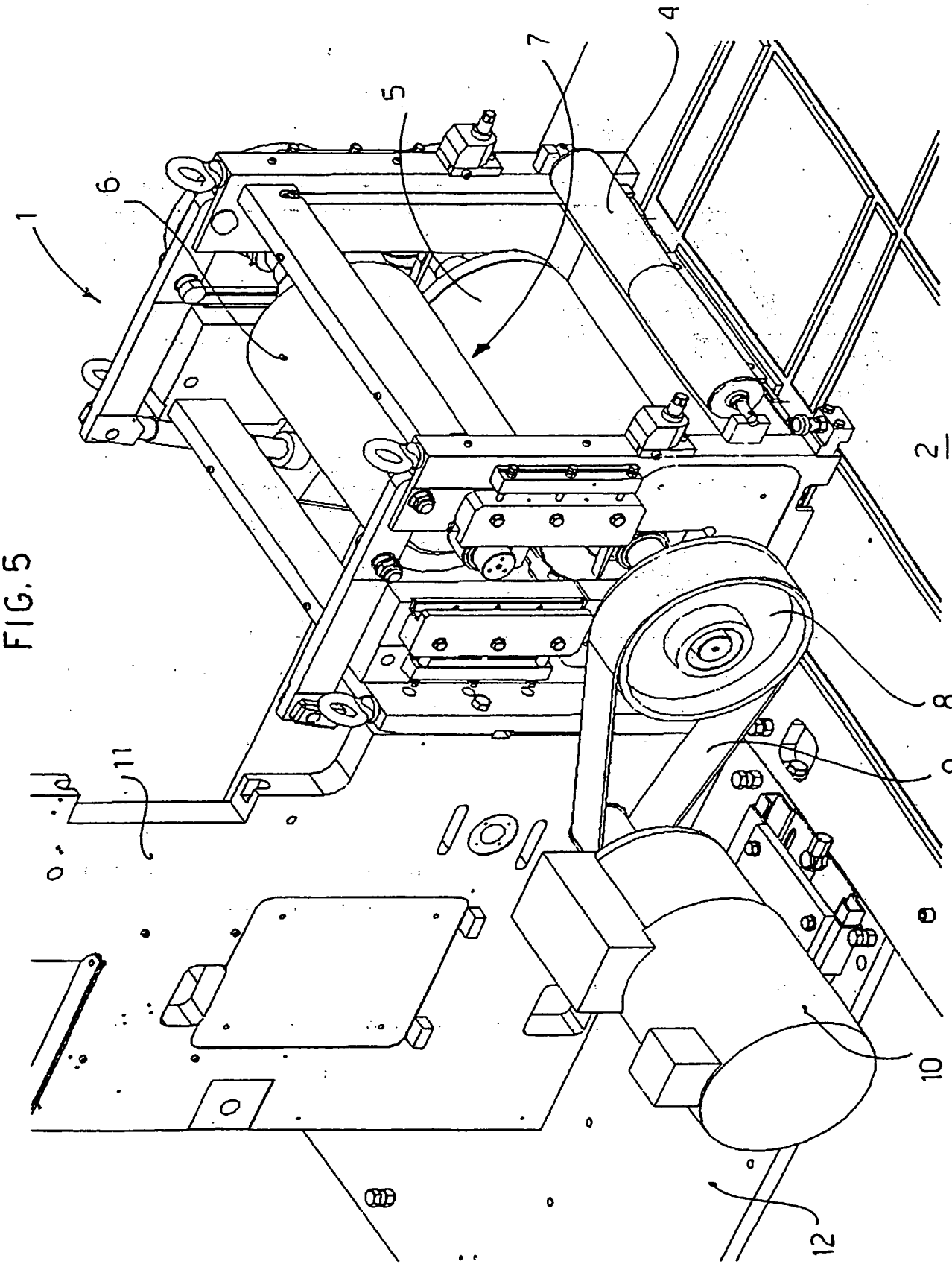


FIG. 5

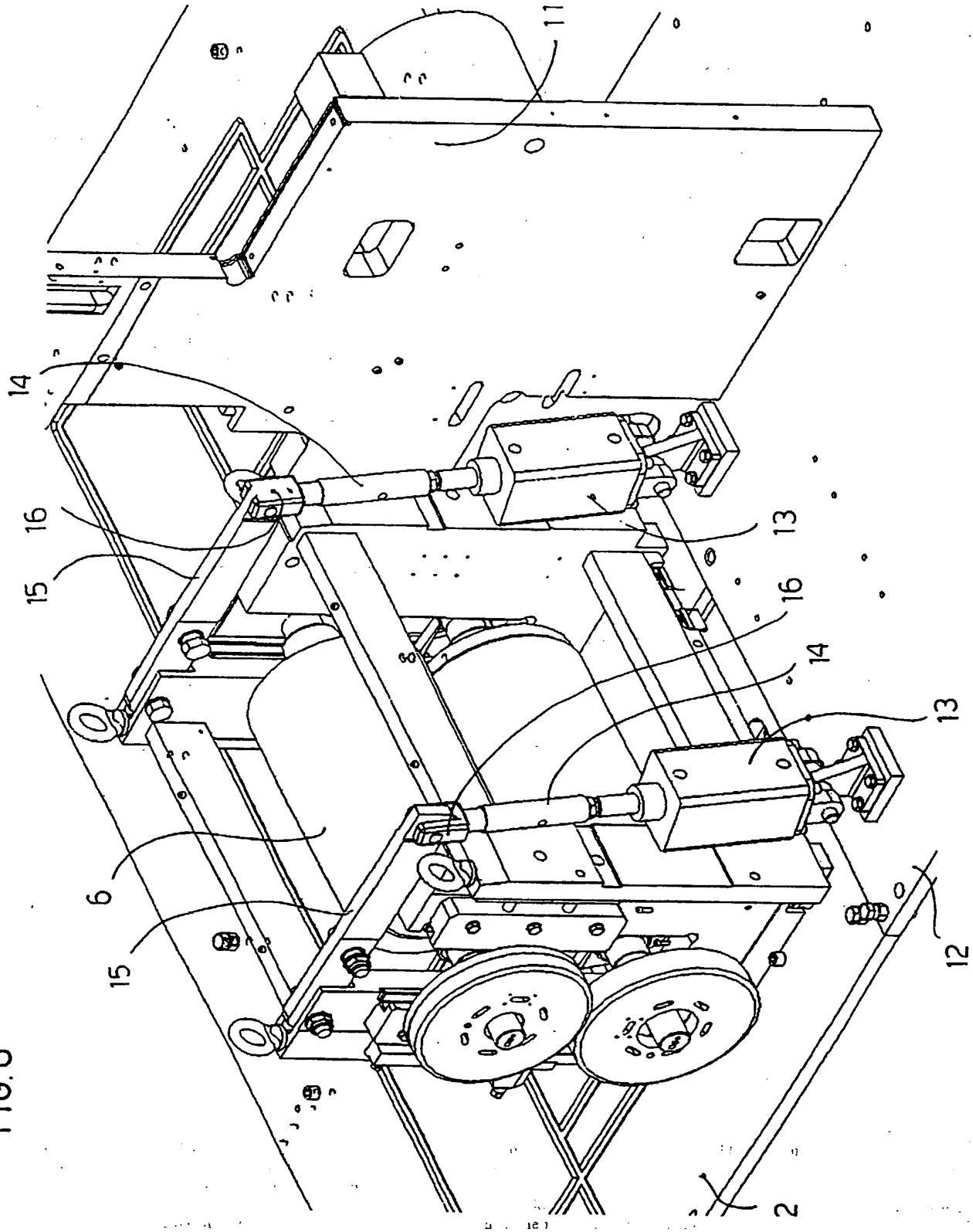


FIG.6

EMBOSSING ASSEMBLY AND RELATIVE MOVEMENT SYSTEM

The present invention refers to an embossing assembly and relative movement system, for machines for the treatment of sheet materials and in particular for the production of paper napkins or serviettes.

The description that follows will be provided using as an example paper napkins or serviettes, but it should be understood that this is not intended thereby in any way to limit application of the invention solely to paper napkins or serviettes.

A prior art machine for production of paper napkins or serviettes comprises an unwinding assembly that supports a reel of paper web that is driven toward an embossing assembly that is responsible for embossing of the web. Downstream of the embossing assembly a folding and cutting assembly is provided which is responsible for folding and cutting of the web so as to obtain paper napkins or serviettes which are disposed in stacks for packaging.

An embossing assembly comprises an embossing module or a plurality of modules, each module comprising a pair of counter-rotating embossing rolls for embossing the sheet material that passes in the nip formed therebetween.

Generally, in machines for production of paper napkins or serviettes, an embossing module is disposed horizontally upstream or beneath a folding plate forming part of a folding assembly. That is to say, the axes of the embossing rolls are substantially parallel and disposed along a horizontal plane.

Such an embossing assembly consisting of a single module holds some drawbacks for changes in production. In fact, in this case, the embossing rolls must be removed from the module and replaced with other embossing rolls. To carry out this operation it is necessary to upturn the pressure system that acts on the rolls, horizontally translate the rolls to remove them from the module, insert the new rolls and adjust the pressure

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system on the new rolls. It is obvious that these operations prove awkward, laborious and require long machine downtime.

Embossing assemblies are known to the art which have replacement or additional modules disposed vertically, and in line, upstream from the folding plate. That is to say, each vertical module has a pair of embossing rolls with their axes disposed substantially in a vertical plane.

These vertical modules also present drawbacks during production changes. In fact, the embossing rolls are removed from the top of the module and replaced with other rolls also mounted from the top of the module. Moreover, after replacement of the rolls, the drive transmission control and the system for applying pressure to the rolls must be regulated in each module. Furthermore, the vertical arrangement of the additional modules causes an increase in the space occupied on the machine.

Embossing assemblies are known to the art which in place of the vertical modules have so called vertical towers. The vertical towers are compact modules which comprise a pair of embossing rollers mounted irremovably therein. In this case, for production changes the vertical tower must be raised and shifted sideways to leave space for a new vertical tower to be positioned. Said operation is quite awkward and complex because of the considerable weight of the entire tower and requires the use of auxiliary lifting means, such as hoists and the like. Furthermore, the vertical towers cannot be placed beneath the folding plate.

The object of the present invention is to eliminate the drawbacks of the prior art by providing an embossing assembly and relative handling system that are practical, versatile, occupy little space and are simple to make.

Another object of the present invention is to provide such an embossing assembly and a relative handling system that are able to reduce to a minimum machine downtime during production changes.

These objects have been achieved in accordance with the invention with the characteristics listed in appended independent claim 1.

Advantageous embodiments of the invention are apparent from the dependent claims.

The embossing assembly according to the invention comprises at least one embossing module which comprises two counter-rotating embossing rolls. Said embossing module in the working position must be positioned in line with a folding plate for folding of the embossed web coming from the embossing module.

A peculiarity of the invention lies in the fact that the embossing module is mounted translatably on a supporting plate. In this manner, during a production change, the user can move the embossing module from the working position and replace it with a new embossing module that is translated on the supporting plate.

The embossing assembly of the invention preferably provides a carousel system consisting of a plurality of embossing modules, preferably mounted translatably on the supporting plate. In this manner the first embossing module is in the working position, the second embossing module is in a standby position ready to replace the first module in the working position, and the third module is in a reserve position, ready to replace the second module.

The advantages of the embossing assembly according to the invention are evident. In fact, said handling system allows fast and easy production changes, without the need to remove the embossing rolls from the modules or to move the modules with the aid of hoists or other machinery.

Further characteristics of the invention will be made clearer by the detailed description that follows, referring to a purely exemplary and therefore non-limiting embodiment thereof, illustrated in the appended drawings, in which:

Figure 1 is an axonometric view showing an embossing assembly according to the invention;

Figure 2 is a perspective view showing a supporting plate of the embossing assembly according to the invention;

Figure 3 is an axonometric view from below of a module of the embossing assembly according to the invention;

Figure 3a is a diagrammatic plan view from below of an embossing module;

Figure 4 is a sectional partial view showing the coupling between a module and the supporting plate of the embossing assembly according to the invention;

Figure 5 is a perspective partial view, taken from the front (web entry side), showing a module of the embossing assembly in the working position and in which the outer shell of the module has been removed;

Figure 6 is a broken off perspective view taken from the rear (exit side of the web) showing the module of Figure 5 in the working position.

The embossing assembly and relative handling system according to the invention is described with the aid of the figures.

Figure 1 shows an embossing assembly according to the invention, denoted as a whole by reference numeral 100. The embossing assembly 100 comprises three embossing modules 1, 1' and 1". Module 1 is in a working position, module 1' is in a standby position for replacement of module 1 and module 1" is in a reserve position.

The three modules are supported on a supporting plate 2. The module 1 is situated beneath folding plate 3 forming part of the folding group. The folding plate 3 is supported above the module 1 by means of a pair of shoulders 11 supported by a base 12 disposed at the same height as the supporting plate 2.

In the figures, by way of example, the working position of the module 1 is shown beneath the folding plate 3. However, the working position of the module 1 could also be upstream of the folding plate 3; the important thing is that the working module 1 be in line with the folding plate 3.

The web of paper coming from a large reel enters the embossing module 1, is embossed, leaves the embossing module 1 and is driven toward the folding plate 3.

Alongside the module 1, on the same plane as the supporting plate 2, a carriage is provided comprising a slide 30 supported on swivel wheels, for possible ejection and transport of the module 1 during a change in production.

As shown in figure 5, the embossing module 1 comprises an idle roller 4 disposed at the entrance of the web and two embossing rolls 5 and 6 having their outer surfaces substantially touching so as to form a nip 7 for passage of the web.

The idle roller 4 and the embossing rolls 5 and 6 have their axes substantially parallel to the supporting plate 2.

The two embossing rolls 5 and 6 take their drive from a pulley 8 disposed on a side wall of the module 1. The pulley 8 is rotated by a belt 9 driven by a motor 10 disposed on the base 12 alongside a shoulder 11 of the folding assembly. A mechanism will be provided in the module 1 to invert the drive imparted by the pulley 8, so that the two embossing rolls 5 and 6 can rotate in opposite directions.

As shown in Figure 6, two linear actuators 13 are positioned behind the module 1, on the base 12 of the folding assembly. Each linear actuator 13 comprises a cylinder-piston unit and is operated hydraulically or pneumatically. The rods 14 of the actuators 13 act respectively on two bars 15 disposed in the upper part of the module 1 to adjust the pressure of the embossing roll 6 over the embossing roll 5 during the embossing stage. In particular, each rod 14 of the linear actuators 13 terminates in a fork 16 which engages the end of the respective bar 15.

As shown in Figure 3, in the vicinity of the four corners of the base 17 of the module 1, four seats 18 are present wherein respective balls 19 are rotatably mounted. The balls 19, being free to rotate in their seats 18, act as wheels for the module 1 and allow any type of movement.

To be precise, the seats 18 with the respective balls 19 are mounted in staggered pairs. That is to say, on the front side of the module 1 (web entry side) the balls 19 are near the two end corners of the base 17. On the rear of the module 1 (web exit side), on the other hand, the balls 19 are at a slight distance from the corners of the base 17. Thus the centre distance between the pairs of balls of the rear side is smaller than the centre distance between the pair of balls on the front side.

Feet 20 disposed at right angles to the base 17 and protruding therefrom by a smaller height than that of the balls 19 are provided on the outer perimeter of the base 17.

In Figure 3a the base 17 is shown schematically with the four balls 19-1, 19-2, 19-3 and 19-4. The base 17 is disposed in a Cartesian plane in which the axis X is parallel to the front a and rear b sides of the base 17 and the axis Y is parallel to the two lateral sides of the base 17. In particular the pair of balls 19-1 and 19-2 is disposed on the front side a and the pair of balls 19-3 and 19-4 is disposed on the rear side b.

In said figure:

x1-2 is a straight line parallel to the axis X passing through the centres of the balls 19-1 and 19-2;

x3-4 is a straight line parallel to the axis X passing through the centres of the balls 19-3 and 19-4;

y1, y2, y3 and y4 are the straight lines parallel to the axis Y passing respectively through the centres of the balls 19-1, 19-2, 19-3, 19-4.

In order for the base 17 to be able to translate in the direction of the axis X, the balls 19 must engage in a track which provides two lanes or rails corresponding to the straight lines x1-2 and x3-4. The distance between the straight lines x1-2 and x3-4 is indicated by d2.

In order for the base 17 to be able to translate in the direction of the axis Y, the balls 19 must engage in a double track which provides two pairs of lanes, a first pair

corresponding to the straight lines y1 and y3 and a second pair corresponding to lines y4 and y2. In particular, the centre distance between the first pair of straight lines y1 and y3 is indicated by d1 and is equal to the distance between the second pair of straight lines y4 and y2. The distance between the straight lines y3 and y4 is indicated by d3.

With reference to Figure 2, tracks consisting of lanes inside which the balls 19 can roll are formed on the supporting plates 2. In particular, two longitudinal tracks are formed in the direction of the axis X and two double transverse tracks are formed in the direction of the axis Y. By double track, a track with two double rails is meant.

In the direction of the axis X the first longitudinal track is formed by the pair of lanes PX1 and PX2 and the second longitudinal track is formed by the pair of lanes PX3 and PX4 which leave at one side end of the plate 2, level with the carriage 30. The centre distance between the lanes PX1 and PX2 is equal to the centre distance between the lanes PX3 and PX4 and is equal to d2.

In the direction of the axis Y the first double transverse track is formed by the lanes PY1, PY2, PY3, PY4, and the second double transverse track is formed by the lanes PY5, PY6, PY7 and PY8. The centre distances between the lanes (PY1-PY2), (PY3-PY4), (PY5-PY6) and (PY7-PY8) are equal to each other and to d1. The centre distance between the lanes (PY2-PY3) is equal to the centre distance between the lanes (PY6-PY7) and is equal to d3.

In particular, the lanes PY1, PY4, PY5 and PY8 are delimited between the lanes PX1 and PX3. The lanes PY2, PY3, PY6 and PY7 are delimited between the lanes PX2 and PX4.

The lanes PY1 and PY4 end in respective recessed seats S1 and S4 disposed between the runways PX1 and PX2. The lanes PY2 and PY3 end in respective recessed seats S2 and S3 disposed beyond the rail PX1, at the rear end of the plate 2.

When the module 1 is in the working position, shown in Figure 1, the balls 19-1 and 19-2 of the front side are respectively in the seats S1 and S4 and the balls 19-3 and 19-

4 are respectively in the seats S2 and S3. In this situation, as shown in Figure 4, the balls 19 remain raised with respect to the bottom of the seats S1 – S3 and the feet 20 are in contact with the supporting plate 2, supporting the module 1 and avoiding any sliding of module 1 during the work cycle. Furthermore, module 1 is fixed by means of screws to the shoulders 11, to ensure its stability.

Module 1' is in the standby position in which the balls 19 are situated respectively at points A1, A2, A3 and A4, which are respectively the end of stroke points in which the first longitudinal track (PX1, PX2) meets the second double transverse track (PY5, PY6, PY7, PY8).

Module 1" is in the reserve position in which the balls 19 are situated respectively at points R1, R2, R3 and R4, which are respectively the end of stroke points in which the second longitudinal track (PX3, PX4) meets the second double transverse track (PY5, PY6, PY7, PY8).

Operation of the movement system of the embossing assembly according to the invention will now be described.

When a change in production is desired, the motor system 10 of the embossing assembly is stopped and the belt 9 is released from the pulley 8 of the module 1 which is in the working position. Then rods 14 of the actuators 13 are released from the bars 15 which adjust the pressure of the embossing rolls of module 1 and lastly the screws that secure module 1 to the shoulders 11 are unscrewed.

At this point, module 1 is free and can be ejected from the plate 2 onto the carriage 30 or can be maintained as the reserve module.

In the event of wanting to eject module 1, the following operations are performed.

Module 1 is manually retracted in the direction Y on the first double transverse track until the balls 19 disengage from the seats S1-S4, then the module is pushed in direction FY1. When the balls 19-3 and 19-4 are level with the lane PX3 and

consequently the balls 19-1 and 19-2 are level with the lane PX4, module 1 is moved in the direction of the arrow FX2 (Figure 1) so as to be ejected toward the carriage 30.

Then the replacement module 1' is pushed in the direction of the arrow FX1 on the first longitudinal track formed by the lanes PX1 and PX2 until its balls 19 reach the end of stroke point at the crossing between the first longitudinal track (PX1, PX2) and the first double transverse track (PY1, PY2, PY3, PY4). At this point module 1' is pushed in the opposite direction to the arrow FY1, until the four balls 19 come into the four seats S1-S4.

Module 1' is then secured to the shoulders 11 by means of screws, then the belt 9 is mounted on the pulley 8 and lastly the rods 14 of the actuators 13 are coupled to the bars 15 of the system for applying pressure to the embossing rolls. At this point the machine can be started to resume the work cycle.

If desired, the reserve module 1" can be moved in the direction of the arrow FY2, on the second double transverse track formed by the lanes PY5, PY6, PY7, PY8, to occupy the standby position previously occupied by module 1'.

Alternatively module 1" can be brought directly into the working position.

The case in which module 1 is not to be ejected but must be put into the reserve position will now be described. In this case module 1 is retracted on the first double transverse track in the direction of the arrow FY1 up to the end of stroke point. Then the module 1', which is in the standby position, is pushed in the direction of the arrow FX1 on the first longitudinal track formed by the lanes PX3 and PX4 until its balls 19 reach the end of stroke point at the first double transverse track formed by lanes PY1, PY2, PY3 and PY4. Finally, module 1' is pushed in the opposite direction to the arrow FY1 until the balls 19 come into the seats S1-S4, so that module 1' is in the working position.

Module 1" is pushed in the direction of the arrows FY2 to occupy the standby position previously occupied by module 1' and module 1 is pushed in the opposite direction to

arrow FX2, on the second longitudinal track, to reach the end of stroke point in the position previously occupied by module 1".

Of course, replacement of the modules can also take place with a movement thereof in an anti-clockwise rather than a clockwise direction, as previously described.

It should be noted that the embossing assembly 100 according to the invention could also be used in the event of the folding plate 3 being mounted hinged to a shoulder 11. In this case the folding plate, by rotating around the axis of the hinge, moves from a working position above the embossing module 1 to a resting position outside the plan area of the embossing module 1.

When the folding plate 3 is in the resting position, embossing rolls 5 and 6 of the embossing module can be replaced by acting from above the module, or module 1 can be directly lifted and moved.

Numerous changes and modifications of detail within the reach of a person skilled in the art can be made to the present embodiment of the invention, without departing from the scope of the invention expressed by the appended claims.

CLAIMS

1. An embossing assembly (100) comprising at least one embossing module (1, 1', 1") which comprises two counter-rotating embossing rolls (5, 6) for embossing sheet material,
characterized in that said at least one embossing module (1) is mounted translatably on a supporting plate (2) to be able to be moved from a working position to a resting position.

2. An embossing assembly according to claim 1, characterized in that said working position corresponds to a position in which said embossing module (1) is in line with a folding plate (3) for folding the sheet material leaving the embossing module.

3. An embossing assembly according to claim 2, characterized in that said working position corresponds to a position in which said embossing module (1) is situated beneath said folding plate (3).

4. An embossing assembly according to any one of the preceding claims, characterized in that it comprises at least one replacement embossing module (1') mounted slidably on said supporting plate and disposed in a replacement position to be able to replace said working module (1) disposed in said working position.

5. An embossing assembly according to claim 4, characterized in that it comprises at least one reserve embossing module (1") mounted slidably on said supporting plate (2) and disposed in a reserve position, to be able to replace said replacement module (1') disposed in the replacement position.

6. An embossing assembly according any one of the preceding claims, characterized in that at least one of said embossing modules comprises in its lower base (17) seats (18) wherein are rotatably mounted respective balls (19) able to allow translation of the module over said supporting plate (2).

7. An embossing assembly according to claim 6, characterized in that said base (17) of the module is essentially rectangular and comprises four balls (19) disposed in staggered pairs near the four corners of said base (17).

8. An embossing assembly according to claim 7, characterized in that the centre distance between a pair of balls disposed on the side of the base (17) facing toward the front part of the module wherein the sheet material enters is greater than the centre distance of the pair of balls disposed on the side of the base (17) facing toward the rear part of the module wherefrom the sheet material exits.

9. An embossing assembly according to any one of claims 6 to 8, characterized in that provided in the perimeter of said base (17) of the module are downward protruding feet (20) having a smaller height than the height of the balls (19).

10. An embossing assembly according to any one of claims 7 to 9, characterized in that a plurality of lanes are formed on said supporting plate (2) such as to allow rolling of said balls (19).

11. An embossing assembly according to claim 10, characterized in that formed on said supporting plate are two longitudinal tracks, each made of a respective pair of lanes (PX1, PX2) and (PX3, PX4), and two double transverse tracks, each respectively made of two pairs of lanes (PY1, PY2, PY3, PY4 and PY5, PY6, PY7, PY8).

12. An embossing assembly according to any one of claims 9 to 11, characterized in that said supporting plate (2) provides recessed seats (S1, S2, S3, S4) to receive said balls (19) when the embossing module (1) is in said working position, so that said feet (20) can rest on said supporting plate (2) and the balls (19) can remain raised inside said recessed seats.

13. An embossing assembly according to claim 12, characterized in that said recessed seats (S1, S2, S3, S4) are situated at the end of the lanes (PY1, PY2, PY3, PY4) of said first double transverse track.

14. An embossing assembly according to any one of the preceding claims, characterized in that it comprises a carriage (30) disposed on one side of said supporting plate (2) for ejection of an embossing module from said supporting plate.

15. An embossing assembly according to any one of the preceding claims, characterized in that at least one of said embossing modules comprises a pulley (8) disposed laterally to drive said embossing rolls (5, 6), said pulley being rotated by a belt (9) driven by a motor (10) disposed on a supporting shoulder (11) of said folding plate (3).

16. An embossing assembly according to any one of the preceding claims, characterized in that it comprises a pressure applying system for applying pressure to the embossing rolls (5, 6), said pressure applying system comprising a pair of linear actuators (13) disposed on a base (12) that supports said shoulder (11), the rods (14) of said linear actuators acting on bars (15) of said embossing module (1) to apply pressure to the embossing rolls (5, 6).

17. An embossing assembly according to any one of the preceding claims, characterized in that said folding plate (3) is hinged to a supporting shoulder (11) so that said folding plate (3) can be moved from a working position in line with said embossing assembly (1) to a resting position outside the plan area of said embossing module (1).

18. An embossing assembly according to any one of the preceding claims, for production of paper napkins or serviettes and the like.

19. An embossing assembly substantially as hereinbefore described with reference to the accompanying drawings.

Application No: GB 0206490.5
Claims searched: 1-19
Examiner: Roger Binding
Date of search: 16 May 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): B6J (JG3)

Int Cl (Ed.7): B29C 59/00, 59/04; B31F 1/07; B44B 5/00

Other: Online WPI EPODOC JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	EP 0827926 A	(ARPECO ENG.)	
X	WO 00/56475 A1	(BOEGLI GRAVURES), see the embodiment of Figs 6 & 7.	1, 18
A	US 4732082 A	(IRETON), see column 4, line 13 onwards.	
A	JP 550024706 A (YURI ROLL KIKAI), see drawings and abstracts.		

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.